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REVIEW OF NATIONAL DATA PROCESSING CAPABILITIES IN AFRICA

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I. Introduction

1. This report presents the results of the Seventh Biennial Regional Survey of Electronic Data Processing (EDP) Capabilities and requirements. The survey was conducted over the period of 25 March to 30 September 1985. Unlike its predecessors, it was limited to only all known organizational units which perform government planning, demographic, and/or statistical work. It inquired into the related hardware and software facilities, equipment utilization, staffing and EDP problems encountered.

2. The questionnaires were addressed to 100 organizational units in 50 developing African countries. Furthermore, National Statistical Offices were also requested to help in the identification of EDP centres in their countries belonging to the survey coverage by dispatching extra copies of the questionnaire which were sent to them. Replies were received from only 25 respondents as shown in table 1. The responses being far from comprehensive, the results of the 1983 EDP survey were also used to fill gaps wherever possible. The results contained in this report must therefore be interpreted with care because the EDP situation may have changed since the 1983 survey in the organizational units which have not responded.

Table 1. Responses to Questionnaire

Sub-Region	Countries			National Statistical Offices			Other Offices			All Organizational Unit		
	QS[a/]	QR[b/]	%[c/]	QS	QR	%	QS	QR	%	QS	QR	%
North Africa	6	1	17	6	-	-	3	1		9	1	11
West Africa	16	7	44	16	5	31	18	3		34	8	24
Central Africa	10	1	10	10	1	10	6	2		16	3	19
East & Southern Africa	18	10	56	18	4	22	23	9		41	14	32
TOTAL	50	19	38	50	10	20	50	15		100	26	25

a/ QS = Questionnaires sent

b/ QR = Questionnaires returned

c/ % = Percentage of response rate

3. The information obtained from the survey is presented in the Directories of relevant EDP centres and experts (E/ECA/PSD.4/47 and E/ECA/PSD.4/48). The tables contained in the report summarize information from the above document.

II. Hardware

4. The survey attempted to identify organizational units which use EDP facilities in performing their work, and inquired into the make, model, number, main memory size, cycle time, operating systems, date of acquisition of the central processing units (CPU), processing type (batch and/or interactive). It also aimed at distinguishing between main frames and other CPU types (front end, mini or micro computer). As far as peripherals were concerned, information was sought on their make, model, number and characteristics.

(a) Central Processing Units

5. The data shown below may not reflect the correct distribution of CPU among countries of the region because the number of organizational units for which information is available is not necessarily complete in respect of any country. The data provide, however, the lower bound for the number of EDP equipment being used in organizational units performing government planning, statistical and/or demographic work in the region.

6. Information was available for 195 central processing units in 70 organizational units in 38 countries. The most represented makes were HEWLETT PACKARD (HP) with 45 CPU, WANG with 36, IBM with 33 and ICL with 23. These four makes together accounted for 74 per cent of the central processing units used in the region for performing government planning, statistics and/or demographic work.

7. Concerning the regional distribution of makes WANG appeared to be most popular in West Africa (52 per cent of CPU used in this sub-region) as opposed to HEWLETT PACKARD (33 per cent). The number of CPU in North Africa was under estimated due to the very low response rate from this sub-region. But, it is worth noticing that the use of these makes was concentrated in only few organizational units: 7 for WANG against 6 for HP.

Table 2. Estimated Number of CPU by Make and by Sub-region in African Countries

Make	SUB-REGION				
	North Africa	West Africa	Central Africa	East and Southern Africa	Total
HP	-	-	6	39	45
WANG	-	34	-	2	36
IBM	2	12	3	11	33
ICL	-	5	-	19	24
CII	2	2	2	1	7
Other	-	13	10	17	40
Not stated	1	-	-	-	1
TOTAL	5	66	26	89	186

8. The median main memory size was between 48 and 256 K-bytes. Seventy five per cent of the central processing units for which information is available had a primary memory size ranging from 48 to 1024 K-bytes. Six CPU had a primary memory size exceeding two mega-bytes.1/

Table 3. Main Memory Size (K-bytes) of CPU by Make

Make	MAIN MEMORY SIZE						
	<48	[48-256[	[256-1024[	[1024-4096[	≥4096	Not stated	Total
HP	1	11	23	5	-	-	45
WANG	1	26	6	-	-	3	35
IBM	4	8	8	5	2	6	33
ICL	4	9	4	2	1	4	24
CII	-	1	2	3	-	1	7
Other	1	26	10	-	2	1	40
Not stated	-	-	-	-	-	1	1
TOTAL	11	81	58	15	5	16	186

1/ Botswana, Government Computer Bureau, ICL 12M-bytes
Senegal, Direction du traitement automatique de l'Information (DTAI), IBM 4 M-bytes and 8M-bytes
Zambia, Ministry of Finance, ICL, 4 M-bytes
Zimbabwe, Scientific Computer Centre, PERKIN ELMER 6 M-bytes and ICL 4 M-bytes.

9. Among central processing units of which main memory size equalled or exceeded 1 mega-byte were 7 IBM, 5HP and 3 ICL. The makes Ibm and ICL were also represented among CPU whose primary memory size was less than 4 K-bytes providing thus a wide variety of CPU for organizational units performing government planning, statistics and/or demographic work in the region.

10. Sixty eight central processing units with a main memory equalling or exceeding 256 K-bytes were acquired between 1982 and 1985 against only 16 such CPU before 1982. Apparently, no CPU with a main memory size less than 48 K-bytes has been acquired since 1981.

Table 4. Acquisition Date and Main Memory Size (K-bytes) of CPU

Acquisition Date	MAIN MEMORY SIZE						
	<48	[48-256[	[256-1024[	[1024-4096[	≥4096	Not stated	Total
Prior to 1970	2	-	-	-	-	-	2
[1970-1975[	2	2	2	-	-	-	6
[1975-1980[	2	1	1	1	-	2	7
1980	1	5	1	4		1	12
1981	-	12	-	-	1	1	14
1982	-	6	7	3	1	-	17
1983	-	35	20	2	1	1	59
1984	-	7	10	1	1	-	19
1985	-	-	1	1	-	-	2
Not stated	4	14	8	3	1	11	41
TOTAL	11	81	58	15	5	16	186

11. Information concerning the type of processing (batch and/or interactive) was available for 32 organizational units in 24 countries. Sixty six central processing units out of 141 for which information on processing type was available processed data interactively only against 9 by batch only. Twenty organizations used both types of processing.

12. All CPU using interactive processing type had their primary memory size laying between 48-1024 K-bytes. Sixty six per cent of these CPU had even a primary memory size less than 256 K-bytes.

Table 5. Main Memory Size and Processing Type in 32 Organizational Units

Processing Type	MAIN MEMORY SIZE						
	<48	[48-256[	[256-1024[	[1024-4096[	>4096	Not stated	Total
Batch only	-	3	3	3	-	-	9
Interactive only	-	37	29	-	-	-	76
Batch & interactive	1	3	11	5	1	1	22
Not stated	1	9	3	-	-	24	34
TOTAL	2	62	43	8	1	25	141

13. Out of the 176 central processing units for which information is available, 53 CPU used 8-byte processors where as the numbers of CPU using 16 K-byte, 32 K-byte were 14 and 7 respectively. One CPU was said to use 18 K-byte processors and another are 24 K-byte processors. Information on cycle time was provided for only 46 CPU. This time varied from 0.25 nanoseconds to 1 microsecond averaging 103 nanoseconds.

(b) Peripherals

14. Secondary memory consists of a variety of storage devices which were used to store data items of less immediate interest to programmes being executed. The most prevalent secondary memory devices was magnetic disks and tapes. Magnetic disks and tapes represented 51 and 34 per cent of secondary memory devices respectively. Their high utilization may account for the fact that they offer voluminous space for storage at a cheaper cost. Furthermore, magnetic tapes enable back-up and restoring of information on disks of large capacity. They also offer large volumes of information for archival purposes and routine sequential processing tasks.

15. Recording mode for magnetic tapes ranged from 1500 to 6600 bits per inch providing greater possibility of storage. The storage capacity of magnetic disks lay between 40 and more than 319 mega-bytes.

16. Diskette devices are more frequently used now with the increase in the number of powerful microcomputers in the region. However, these devices still represent only 23 per cent of all magnetics disks.

17. One hundred sixty four printers were [illegible] in the 7[illegible] organizational units for which information was available, out of which 41 were dot matrix printers and 17 daisy printers. They were generally performing at the rate of [illegible] lines per minutes. Their speed exceeded 1000 lines per minutes in [illegible] cases.

18. The number of terminals reported reached 572 [illegible], 14 per organizational unit. Fourteen plotters were reported in 10 organizational units. Sixty four modulator-demodulator (modem) units at speeds of [illegible] bauds were reported in 7 organizational units.

19. The distribution of peripherals showed that IBM was predominant for magnetic storage devices as opposed to ICL for terminals and printers.

Table 6. Peripheral Devices by Make

Make	PERIPHERAL DEVICES									
	Paper tape unit	Card unit	Magnetic tape unit	Magnetic disk unit	Printer	Terminals	Plotter	Modem	Other	Total
HP	-	4	29	42	20	194	[illegible]	[illegible]	-	[illegible]
IBM	-	19	68	94	29	101	2	[illegible]	1	[illegible]
ICL	26	17	34	49	57	183	1	[illegible]	1	[illegible]
WANG	2	-	5	9	10	34	-	[illegible]	1	[illegible]
CII	-	6	18	39	7	12	1	10	[illegible]	101
Other	-	2	15	19	50	132	2	[illegible]	-	[illegible]
TOTAL	28	48	169	252	164	572	14	64	3	[illegible]

III. Software

20. Particulars were sought on the name, version and frequency of utilization of languages and packages available. Questions on main and auxiliary applications to which packages were put were also asked.

(a) Languages

21. COBOL was the language most used, followed by FORTRAN, BASIC, ASSEMBLY, RPG II, PL1, PASCAL, etc., in that order. These high-level languages except ASSEMBLY, RPG II, PL1 and PASCAL were used in all organizational units where they were available, enabling the development of custom systems for data processing and the interfacing of statistical packages.

22. COBOL was reported to be extensively used in 23 organizational units. Then, BASIC, FORTRAN, PL1, RPG followed with 13, 11, 3, 3 organizational units respectively. PASCAL, SLC, and PROCEDURE (WANG) were said to be extensively used in one organizational unit each.

Table 7. Number of Organizational Units where Languages are used and their Frequency of Utilization

Language	Extensively used	Occasionally used	Never used	Total
COBOL	23	8	-	31
FORTRAN	11	19	-	30
BASIC	13	9	-	22
ASSEMBLY	2	15	3	20
RPG II	3	9	3	15
PL 1	3	5	4	12
PASCAL	1	3	1	5
ALGOL	-	2	-	2
PLAN	-	2	-	2
SLC	1	-	-	1
GAP	-	1	-	1
PROCEDURE	1	-	-	1
SPL	-	1	-	1
OPTIMIZER	-	1	-	1
AUTOCODER	-	1	-	1

23. Packages were reported for very few organizational units. CONCOR was said to be used in 14 organizational units, SPSS in 14, COCENTS in, CENTS(mainly CENTS 4), X-TALLY in 4 each, BIBLOS and TSP in 3 each, CLUSTERS, UNEDIT, SUPERCALC, LEDA, COXTALLY in 2 each.

24. The most frequent applications to which these various packages were put were: table/report generation (cited 18 times), statistical data analysis (11), text processing (9), data editing (3), data base management (7), data file handling (5), and data dictionary (1).

25. Data base management systems were reported for 8 organizational units and concerned the following DBMS: IMAGE 3000, MINISIS, PLAN 80, ELFIE, and RAPID. Only IMAGE 3000 and MINISIS were said to be extensively used in 2 organizational units [United Nations Economic Commission for Africa (ECA), and the International Livestock Centre for Africa (ILCA)]

IV. Equipment Utilization

26. Information was sought on the various electronic data processing tasks undertaken. Respondents were also requested to furnish particulars on the average number of hours performed per day for each task, the time used for data entry and the number of records on storage.

27. The computer time spent on various tasks varied enormously between organizational units for which information was available. It ranged from 4 to 20 hours per day, this being possible because of simultaneous use of working multiposts. It averaged 13 hours while the daily average time for data entry for these applications was 7 hours. In the countries where censuses or surveys were in progress such activities absorbed the greatest amount of time, otherwise generally accounting, agricultural statistics, demographic statistics, training, data analysis, trade statistics, programme development, price statistics, health statistics, payroll, modelling, etc. in that order accounted for the greater workload on the computer. Planning activity was requested for only one organizational unit for half an hour per day.

28. The number of records on storage varied from 10[illegible] to 16 million depending on the type of applications. Censuses, surveys, trade statistics, and demographic statistics were the applications having the highest numbers of records on storage.

V. Staffing

29. The reported number of electronic data processing staff amounted to [illegible]1 of which 59 per cent represented data entry staff, 27 per cent systems and programming staff, 12 per cent offline operations staff. Twenty nine per cent of the EDP staff had statistics background. This percentage was higher among systems and programming staff where it reached 35 per cent.

30. The desirable number of EDP staff was estimated at 1[illegible]06. The existing number of EDP staff was only 77 per cent of that. The shortage of staff was the highest among computer operation, systems development and design and programming. The additional number of staff required represented 38 and 49 per cent of these two categories respectively.

31. It is worth noticing that the additional number of staff required were 112 for system and programming staff, 49 for computer operation, 94 for data entry staff whereas the number of new posts under recruitment were only 32, 3 and 2 respectively. This shows an imbalance between staff requirements and resources available.

VI. EDP Problems

32. Questions on EDP problems encountered were for the first time introduced in the questionnaire. They aimed at the overall problems related to hardware, software, staffing, etc.

33. Information available from 26 organizational units in 20 countries shows that maintenance was very much a problem. Mostly manufacturers were not locally represented. And even when a vendor representative existed in the countries the services offered left much to be desired. In most cases parts were not kept in stocks. Their ordering often left the malfunctioning equipment idle for long time. One organizational unit reported that the waiting time could take up to 6 months. Another stated that the equipment used had to be sent either to France or USA for repair.

34. There were certain environmental requirements for proper maintenance of the hardware and its related supplies. Improper control of temperature, humidity and air quality as well as instability and/or frequent failure of power supply often were responsible for machine failure and damaged supplies.

35. The scarcity of magnetic tapes or disks caused some jobs to be delayed in computer rooms. Sometimes also the existing magnetic disks were not adequate for on-line processing, storing large files, or new programme development.

36. The slow processing speed reported was most of time related to the smallness of the CPU's capacity. Some organizational units facing these problems envisaged the upgrading of their equipment, but in many cases the maximum capacity was already reached. Lack of funds and special difficulty in raising foreign exchange did not often permit the acquisition of additional equipment.

37. Many organizational units did not have compilers on their equipment. It was, therefore, impossible for them to install and use proprietary packages. Furthermore, the lack of compilers made applications programmes slower.

38. The unsatisfactory conditions under which some computers run were due to the lack of supplier's support for systems and/or application software products. The lack of training facilities in the use of systems and/or application software products as well as of systematic channel of information about updates of systems and/or application software products made it difficult to properly use them. Another problem reported was the high cost of licensing packages. It amounted to US dollars 5000 for a package in a country. This accounted to some extent for the little utilization of properietary packages in the region.

39. Generally, these was a shortage of EDP personnel of high calibre, especially in system and programming. Many vacancies were reported in a country in this area but candidates were not available. Among the reasons of this situation was lack of funds and local training facilities.

40. Lack of experience for the existing EDP personnel was also reported. Mostly EDP personnel of high calibre was attracted by organizations offering better conditions of service. The situation was a vicious circle in that it led to the high rate of turnover of personnel.

41. It was stated that the non-EDP subject-matter specialist quite often did not appreciate the fact that programmes had to be written before results could be obtained. Their expectations were somehow very high. It was, therefore, thought that they needed to be given some training in electronic data processing. This also applied to EDP staff for whom statisticians thought that some training in basic statistics was necessary in order to enable them to communicate better with subject matter specialists. Some EDP specialists stated that their success was judged solely on their ability to produce the needed products but how this was accomplished was largely ignored.

42 The lack of possibilities for most of EDP specialists in the region to keep abreast with new developments in their field was a matter of concern all the more as EDP technology had been changing at an exponential speed.

43. The inconvenience caused by the fact for some organizational units depend for their data processing on a unique government EDP organization, the services of which was shared with others, was also reported. This was responsible for bad priority-setting and, therefore, delay in processing jobs.

VII. Miscellaneous

44. Respondents were requested to indicate the kind of technical assistance they were receiving in EDP, and to state, if they were not satisfied with the current technical assistance they were receiving, why and how they wished that it be re-oriented to more efficiently help their country. Particulars were also sought on the location of EDP training facilities available for African EDP students.

45. Technical assistance received in electronic data processing was bilateral and/or multilateral. It concerned equipment software, staff, training among the multilateral agencies cited were UNDP, UNDTCD, UNESCO, UNFPA.

46. Concerning personnel, consultants or advisors in EDP were seconded to African countries to help them in establishing, developing electronic data processing units training counterpart staff, or in undertaking specific tasks (censuses, etc.) African countries received also awards for outside or local training in EDP.

47 It was reported that needs in EDP were important and that technical assistance should be substantially increased in all domains. However attention was drawn to the short stay of technical assistants in some countries which did not result in efficient assistance being given. It was requested that transfer of know-how in EDP be emphasised and that local EDP training facilities especially in system and programming, be given priority.

48. Formal training facilities for electronic data processing were available in 21 countries of the 26 countries for which information is available. Ten of these countries had such facilities offered in universities whereas 5 countries had specialized institutes for EDP training. Statistical training centres like the Institut national de statistique et d'économie appliquée (INSEA), Morocco and the Ecole nationale de statistique et d'économie appliquee (ENSEA), Ivory Coast also provided specialization in EDP.

VIII. Conclusion

49. Most of EDP organizational units performing government planning and statistical work in the region are provided with EDP facilities. There was a tendancy since 1962 to acquire more powerful equipment. Packages were reported for very few organizational units. However, the number of organizations using the statistical package for social science (SPSS) increased substantially. Data base management systems were reported for 8 organizational units but only 2 stated that they were using them extensively. Average daily computer time spent for various tasks was quite impressive. The minimum reported was 7 hours but time devoted to data entry represented a high share of it.

50 There was a great demand for systems and programming staff but the possibilities to hire additional staff was very limited. Generally, there was a shortage of staff of high calibre. Maintenance was very much a problem. Certain environmental conditions were responsible for the malfunctioning of EDP equipment. The fact that some organizational unit did not have compilers or CPU powerful enough, made it impossible for them to instal and use software packages. Therefore, much time was spent on programme development which contributed to delayed outputs. The lack of possibilities for EDP staff in the region to keep abreast with new developments in their field was also of much concern.

51. Respondents thought that technical assistance in EDP should be increased but also re-oriented to focus on transfer of know-how to counterpart personnel in the region.

52. Although the coverage of the survey was limited to only organizational units performing government planning, statistics and/or demographic work, the response rate continued to be low. In order to be able to obtain an accurate picture of EDP capabilities and problems in the region, there should be in each country an organization charged with the responsibility to gather the necessary information. In the absence of such a body, the Central Statistical Office could play that role, or at least initiate such an activity. ECA will centralize the information at the regional level.

53. Most of EDP problems were due to lack of funds allocated to EDP matters. Necessary efforts should, therefore, be made to allocate enough resources to EDP organizational units performing government planning, statistics and/or demographic work, otherwise expected results would continue to be disappointing. On the other hand, EDP organizational units managers should also plan properly their activities giving adequate priorities to avoid disappointing users who might think of finding solutions of their EDP problems by getting their own computer. There is a risk that the EDP situation might worsen in the region.